IEEE P802.11
Wireless LANs

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| Normative text for LB173 GCR comment resolutions |
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Abstract

This document contains proposed resolutions to comments received in LB173 in the GCR category.

3. Definitions, acronyms and abbreviations

3.1 Definitions

advanced groupcast with retries (GCR): A set of features comprised of the GCR block acknowledgement retransmission policy and the GCR service period (GCR-SP) delivery method.(#2379)

active from power save (Active-PS): A delivery method for group addressed frames whereby group addressed frames are transmitted when all associated non-access point (non-AP) stations (STAs) are in active mode or the Awake stateof the power save (PS) mode.(#2377)

groupcast with retries (GCR) service period (GCR-SP): A delivery method for a group addressed stream subject to a GCR agreement wherein the frames are transmitted at regular intervals, where the interval between transmissions(#2053) that might be less than the beacon interval.

active groupcast with retries (GCR) service period (Active GCR-SP): A delivery method for a group addressed stream subject to a GCR agreement wherein the frames may be transmitted without regard to the power state of non-AP STAs. (#2044)(#2410)

concealed groupcast with retries (GCR) frame: A group addressed frame that is transmitted using the aggregate medium access control (MAC) service data unit (A-MSDU) frame format with the destination address (DA) field set to the GCR concealment address. (#2079)

groupcast with retries (GCR) concealment address: A (#2102)medium access control (MAC) address that is used to prevent group addressed frames transmitted via the GCR unsolicited retry(#2278) or GCR Block Ack(#2297) retransmission policies from being passed up the MAC-service access point (MAC\_SAP(#2230)) of GCR-incapable stations.

groupcast with retries (GCR) service: A means for transmission and retransmission of medium access control (MAC) service data units (MSDUs) to a destination that is a group address that provides greater reliability by using (#2376)group addressed retransmissions, concealed from GCR-incapable stations.

non-concealed groupcast with retries (GCR) frame: A group addressed frame that is not transmitted to the GCR concealment address.(#2079)

4.3.aa12.1 Groupcast with retries(#2182)

The groupcast with retries (GCR) service(#2182) allows a STA to request greater reliability for one or more group addressed streams that the STA receives. Greater reliability is provided via (#2380)unsolicited retries, or the Block Ack mechanism. A non-AP STA may request delivery when all associated non-AP STAs are in active(#2182 mode or the Awake state of the PS mode(#2377), so that the AP transmits the frames via EDCA within regular service periods(#2182).

5.1.1.5 Interpretation of service class parameter in MAC service primitives in a STA

Change 5.1.1.5 as follows:

In QoS STAs, the value of the service class parameter in the MAC service primitive (see 5.2) may be a noninteger value of QoSAck or QoSNoAck.

When an MSDU is received from the MAC\_SAP and the recipient STA is a QoS STA with the service class set to

QoSAck, the MSDU is transmitted using a QoS data frame with the Ack Policy subfield in the QoS Control field set to either Normal Acknowledgment (Normal Ack) or Block Ack.

QoSNoAck, the MSDU is transmitted using a QoS data frame with the Ack Policy subfield in the QoS Control field set to No Acknowledgment (No Ack). ~~If the sender STA is an AP and the frame has a group DA, then the MSDU is buffered for transmission and is also sent to the DS.~~

If the sender STA is an AP and the frame has a group DA that is not the GCR concealment address(#2103), then the MSDU is buffered for transmission and is also sent to the DS.

When an MSDU is received from the MAC\_SAP and the recipient STA is not a QoS STA, the MSDU is transmitted using a non-QoS data frame.

When a QoS data frame is received from another STA, the service class parameter in MA-UNITDATA.indication primitive is set to

QoSAck, if the frame is a QoS data frame with the Ack Policy subfield in the QoS Control field equal to either Normal Ack or Block Ack~~.~~,

QoSAck, if the frame is to be delivered via DMS or(#2105) the GCR Block Ack retransmission policy(#2381).

QoSNoAck, if the frame is a QoS data frame with the Ack Policy subfield in the QoS Control field equal to No Ack. This service class is also used where the DA parameter is a group address unless the frame is to be delivered via DMS(#2105) the GCR Block Ack retransmission policy(#2381).

When a non-QoS data frame is received from a STA, the service class parameter in MA-UNITDATA.indication primitive is set to

QoSAck, if the frame is an individually addressed frame and is acknowledged by the STA.

QoSNoAck, if the frame is a group addressed frame and is not acknowledged by the STA.

Note that the group addressed frames sent by a non-QoS STA are not acknowledged regardless of the service class parameter in MA-UNITDATA.indication primitive.

NOTE— GCR frames are only transmitted by a QoS AP or a(#2106) mesh STA

6.3.29 Block Ack

6.3.29.2 MLME-ADDBA.request (#2387)

6.3.29.2.2 Semantics of the service primitive

Insert two extra parameters before the VendorSpecificInfo parameter as indicated:

The primitive parameters are as follows:

MLME-ADDBA.request(

PeerSTAAddress,

DialogToken,

TID,

BlockAckPolicy,

BufferSize,

BlockAckTimeout,

ADDBAFailureTimeout,

BlockAckStartingSequenceControl,

Extended,

GCRGroupAddress,

VendorSpecificInfo

)

Insert the following two parameter descriptions above the VendorSpecificInfo row (note that the entire table is not shown here):

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| Extended | Boolean | true, false | Specifies whether the request is sent using an Extended ADDBA frame or an ADDBA frame.If true, the request is sent using an Extended ADDBA frameIf false, the request is sent using an ADDBA frame |
| GCRGroupAddress | MACAddress | Any valid group MAC address | Specifies the group address for which a Block Ack agreement is requested |

6.3.29.3 MLME-ADDBA.confirm (#2387)

6.3.29.3.2 Semantics of the service primitive

Insert an extra parameter before the VendorSpecificInfo parameter as indicated:

The primitive parameters are as follows:

MLME-ADDBA.confirm(

PeerSTAAddress,

DialogToken,

TID,

ResultCode,

BlockAckPolicy,

BufferSize,

BlockAckTimeout,

GCRGroupAddress,

VendorSpecificInfo

)

Insert the following parameter description above the VendorSpecificInfo row (note that the entire table is not shown here):

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| GCRGroupAddress | MACAddress | Any valid group MAC address | Specifies the group address for which a Block Ack agreement was requested |

6.3.29.4 MLME-ADDBA.indication (#2387)

6.3.29.4.2 Semantics of the service primitive

Insert two extra parameters before the VendorSpecificInfo parameter as indicated:

The primitive parameters are as follows:

MLME-ADDBA.indication(

PeerSTAAddress,

DialogToken,

TID,

BlockAckPolicy,

BufferSize,

BlockAckTimeout,

Extended,

GCRGroupAddress,

VendorSpecificInfo

)

Insert the following two parameter descriptions above the VendorSpecificInfo row (note that the entire table is not shown here):

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| Extended | Boolean | true, false | Specifies whether the received request was contained in an Extended ADDBA frame or an ADDBA frame.If true, the request was received using an Extended ADDBA action frame formatIf false, the request was received using an ADDBA action frame format |
| GCRGroupAddress | MACAddress | Any valid group MAC address | Specifies the group address for which a Block Ack agreement is requested |

6.3.29.5 MLME-ADDBA.response (#2387)

6.3.29.5.2 Semantics of the service primitive

Insert an extra parameter before the VendorSpecificInfo parameter as indicated:

The primitive parameters are as follows:

MLME-ADDBA.response(

PeerSTAAddress,

DialogToken,

TID,

ResultCode,

BlockAckPolicy,

BufferSize,

BlockAckTimeout,

GCRGroupAddress,

VendorSpecificInfo

)

Insert the following two parameter descriptions above the VendorSpecificInfo row (note that the entire table is not shown here):

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| GCRGroupAddress | MACAddress | Any valid group MAC address | Specifies the group address for which a Block Ack agreement was requested |

8.2.4 Frame fields

**8.2.4.1 Frame Control field**

**8.2.4.1.8 More Data field**

Change the fourth paragraph of as follows:

The More Data field is set to 1 in group addressed frames transmitted by the AP when additional group addressed BUs that are not part of an active GCR-SP remain to be transmitted by the AP during this beacon interval. The More Data field is set to 0 in group addressed frames transmitted by the AP when no more group addressed BUs that are not part of an active GCR-SP remain to be transmitted by the AP during this beacon interval and in all group addressed frames transmitted by non-AP STAs.

Insert the following paragraph after the fourth paragraph of

The More Data field is set to 1 in group addressed frames transmitted by the AP when additional group addressed BUs that are part of an active GCR-SP remain to be transmitted by the AP during this GCR-SP. The More Data field is set to 0 in group addressed frames transmitted by the AP when no more group addressed BUs that are part of an active GCR-SP remain to be transmitted by the AP during this GCR-SP. (#2382)

**8.4.2.36 Schedule element**

Change the first paragraph of as follows:

The Schedule element is transmitted by the HC to a non-AP STA to announce the schedule that the HC/AP follows for admitted streams originating from or destined to that non-AP STA, or GCR-SP streams destined to that non-AP STA in the future. The information in this element may be used by the non-AP STA for power management, internal scheduling, or any other purpose. The element information format is shown in Figure 8-158.

Change the third paragraph of as follows:

The Aggregation subfield is set to 1 if the schedule is an aggregate schedule for all TSIDs associated with the non-AP STA to which the frame is directed. It is set to 0 otherwise. The TSID subfield is as defined in 8.2.4.5.2 and indicates the TSID for which this schedule applies. The TSID subfield is reserved when the Schedule element is included within a GCR Response subelement(#2110)(#2238). The Direction subfield is as defined in 8.4.2.32 and defines the direction of the TSPEC associated with the schedule. For a Schedule element sent within a GCR Response subelement(#2110), the Direction subfield is set to Downlink. The TSID and Direction subfields are valid only when the Aggregation subfield is set to 0. If the Aggregation subfield is set to 1, the TSID and Direction subfields are reserved.

Change the fifth paragraph of as follows:

The Service Interval field is 4 octets and indicates the time, expressed in microseconds, between two successive SPs and represents the measured time from the start of one SP to the start of the next SP. If the Schedule element is included within a GCR Response subelement(#2110) that has the GCR delivery method set to GCR-SP, a value of 0 in the Service Interval field indicates the delivery method is Active GCR-SP.

Change the seventh paragraph of as follows:

The HC may set both the Service Start Time field and the Service Interval field to 0 (unspecified) for non-powersaving STAs, except when the Schedule element is included within a GCR Response subelement that has the GCR delivery method set to GCR-SP.(#2239) When the Schedule element is included within a GCR Response subelement that has the GCR delivery method set to GCR-SP,(#2240) the Service Start Time field shall not be set to 0 and the Service Interval field may be set to 0.

**8.2.4.4 Sequence Control field**

**8.2.4.4.2 Sequence Number field**

Change the last paragraph of as follows:

Each fragment of an MSDU or MMPDU contains a copy of the sequence number assigned to that MSDU or MMPDU. The sequence number remains constant in all retransmissions of an MSDU, MMPDU, or fragment thereof, except when the MSDU is delivered via both DMS and group addressed delivery via No-Ack/No-Retry, GCR unsolicited retry(#2278) or GCR Block Ack(#2297) retransmission policies. In these cases the sequence numbers assigned to the MSDUs (re)transmitted using group addressed delivery need not match the sequence number of the corresponding individually addressed A-(#2108)MSDUs delivered via DMS.

8.3.1.9.aa5 GCR Block Ack Variant

The TID\_INFO subfield of the BA Control field of the GCR BlockAck frame contains the TID for which this BlockAck frame is sent.

The BA Information field of the GCR BlockAck frame comprises the Block Ack Starting Sequence Control subfield, GCR Group Address and the Block Ack Bitmap subfield, as shown in Figure 8-aa37. The Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield contains the sequence number of the first A-MSDU for which this BlockAck frame is sent. The value of this subfield is defined in 9.10.aa10. The Fragment Number subfield of the Block Ack Starting Sequence Control subfield is set to 0.

The GCR Group Address field is set to the value from the Group Address subfield of the GCR BAR Information field in the BlockAckReq frame that the BlockAck frame is sent in response to.

The Block Ack Bitmap subfield is 8 octets in length and is used to indicate the received status of up to 64 MSDUs and A-MSDUs. Each bit that is equal to 1 in the Block Ack bitmap acknowledges the successful reception of a single MSDU or A-MSDU in the order of sequence number, with the first bit of the Block Ack bitmap corresponding to the MSDU or A-MSDU with the sequence number that matches the value of the Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield. (#2012)

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Octets: | 2 | 6 | 8 |
|  | Block Ack Starting Sequence Control | GCR Group Address | Block Ack Bitmap |
|  |  |  |  |
| Figure 8-aa37—BA Information field (GCR BlockAck) |

**8.5.aa21.4 Group Membership Response frame format**

The Group Membership Response frame is sent in response to a Group Membership Request frame or upon a change in the dot11GroupAddressesTable object, using the procedures defined in . The Action field of a Group Membership Response frame contains the information shown in Figure 8-aa27.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | Category | Robust Action | Dialog Token | Address Count | Group Address List |
| Octets: | 1 | 1 | 1 | 1 | variable |
| **Figure 8-aa27—Group Membership Response frame Action field format** |

The Category field is set to <ANA> (representing robust AV streaming(#2161)).

The Robust Action field is set to the value specified in for a Group Membership Response frame.

The Dialog Token field is set to the nonzero value of the corresponding Group Membership Request frame. If the Group Membership Report frame is being transmitted other than in response to a Group Membership Request frame, the Dialog token is set to 0.

The Address Count field specifies the number of MAC addresses that are in the Group Address List Field.

The Group Address List field contains zero or more MAC addresses to indicate the set of multicast-group MAC addresses for which the STA receives frames. Each MAC address is 6 octets in length, as described in 8.2.4.3.2. (#2307)

**9.3.2.11 Duplicate detection and recovery**

Change the sixth paragraphs of as follows:

The receiving STA shall keep a cache of recently received <Address 2, sequence-number, fragment-number> tuples. The receiving QoS STA shall also keep a cache of recently received <Address 2, TID, sequence number, fragment-number> tuples for all STAs from whom it has received QoS data frames. QoS STAs with dot11MFQEnabled set to true shall also keep a cache of recently received <Address 2, AC, sequence-number, fragment-number> tuples from IMFQ frames for all STAs from which it has received IMFQ frames. A receiving STA is required to keep only the most recent cache entry per <Address 2-sequence-number> pair, storing only the most recently received fragment number for that pair. A receiving QoS STA is ~~also~~ required to keep only the most recent cache entry per <Address 2, TID, sequence-number> triple, storing only the most recently received fragment number for that triple. A receiving STA with dot11MFQImplemented not present or set to false, and with dot11RobustAVStreamingImplemented (#2274)not present or set to false, may omit tuples obtained from group addressed frames from the cache. A receiving non-mesh STA with dot11RobustAVStreamingImplemented set to true, (#2275)shall keep a cache entry per <DA, (#2323)sequence-number> tuple for each group address subject to a GCR agreement. A receiving mesh STA with dot11RobustAVStreamingImplemented set to true shall keep a cache entry per <DA, Address 2, sequence-number> tuple for each group address subject to a GCR agreement.(#2325) A receiving STA may omit tuples obtained from group addressed or ATIM frames from the cache. A receiving STA with dot11MFQImplemented set to true and with dot11RobustAVStreamingImplemented not present or set to false shall omit tuples obtained from group addressed or ATIM frames from the cache.

9.19.2.5 EDCA backoff procedure

Change the second paragraph of as follows:

For the purposes of this subclause, successful transmission and transmission failure are defined as follows:

* After transmitting an MPDU (regardless of whether it is carried in an A-MPDU) that requires an immediate frame as a response, the STA shall wait for a timeout interval of duration of aSIFSTime + aSlotTime + aPHY-RX-START-Delay, starting at the PHY-TXEND.confirm primitive. If a PHY-RXSTART.indication primitive does not occur during the timeout interval, the STA concludes that the transmission of the MPDU has failed.
* If a PHY-RXSTART.indication primitive does occur during the timeout interval, the STA shall wait for the corresponding PHY-RXEND.indication primitive to determine whether the MPDU transmission was successful. The recognition of a valid response frame sent by the recipient of the MPDU requiring a response, corresponding to this PHY-RXEND.indication primitive, shall be interpreted as a successful response.
* The recognition of anything else, including any other valid frame, shall be interpreted as failure of the MPDU transmission. The recognition of a valid data frame sent by the recipient of a PS-Poll frame shall also be accepted as successful acknowledgment of the PS-Poll frame.
* A transmission that does not require an immediate frame as a response is defined as a successful transmission, unless it is one of(#2277) the non-final (re)transmissions of an MPDU (#2018) that is delivered using the GCR unsolicited retry service(#2278) ().
* The non-final (re)transmission of an MPDU that is delivered using the GCR unsolicited retry(#2278) service ()) is defined to be a failure.
* The final (re)transmission of(#2279) an MPDU that is delivered using the GCR unsolicited retry(#2278) service () is defined as a successful transmission
* The recognition of anything else, including any other valid frame, shall be interpreted as failure of the MPDU transmission.

Insert the following paragraph before paragraph nine of : (#2280)

QoS STAs shall maintain a short retry counter and a long retry counter for each MSDU, A-MSDU, or MMPDU that belongs to a TC that requires(#2280) acknowledgment. The initial value for the short and long retry counters shall be zero. QoS STAs also maintain a short retry counter and a long retry counter for each AC. They are defined as QSRC[AC] and QLRC[AC], respectively, and each is initialized to a value of zero. When dot11RobustAVStreamingImplemented is true, QoS STAs shall maintain a short drop-eligible retry counter and a long drop-eligible retry counter for each AC. They are defined as QSDRC[AC] and QLDRC[AC], respectively, and each is initialized to a value of zero. An AP with dot11RobustAVStreamingImplemented set to true or a mesh-STA with dot11MeshGCRImplemented set to true, shall maintain an unsolicited retry counter. (#2335)

Change the ninth paragraph of as follows:

If the backoff procedure is invoked because of a failure event [reason c) or d) above or the transmission failure of a non-initial frame by the TXOP holder], the value of CW[AC] shall be updated as follows before invoking the backoff procedure:

 If the QSRC[AC] or the QLRC[AC] for the QoS STA has reached dot11ShortRetryLimit or dot11LongRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].

 If the QSDRC[AC] or the QLDRC[AC] for the QoS STA in which(#2281) dot11RobustAVStreamingImplemented is true(#2286) has reached dot11ShortDEIRetryLimit or dot11LongDEIRetryLimit respectively, CW[AC] shall be reset to CWmin[AC].

 Otherwise,

If CW[AC] is less than CWmax[AC], CW[AC] shall be set to the value (CW[AC] + 1)\*2 –1.

If CW[AC] is equal to CWmax[AC], CW[AC] shall remain unchanged for the remainder of any retries.

**9.19.2.6 Retransmit procedures**

Change the first paragraph of 9.19.2.6 as indicated:

~~QoS STAs shall maintain a short retry counter and a long retry counter for each MSDU, A-MSDU, or MMPDU that belongs to a TC requiring acknowledgment. The initial value for the short and long retry counters shall be zero. QoS STAs also maintain a short retry counter and a long retry counter for each AC. They are defined as QSRC[AC] and QLRC[AC], respectively, and each is initialized to a value of zero.~~

Change the second paragraph of 9.19.2.6 and divide it in to five paragraphs as indicated:

After transmitting a frame that requires an immediate acknowledgment, the STA shall perform eitherof the acknowledgment procedures, as appropriate, that are defined in 9.3.2.9 (ACK procedure) and 9.20.3 (Data and acknowledgment transfer using immediate Block Ack policy and delayed Block Ack policy). The short retry count for an MSDU or A-MSDU that is not part of a Block Ack agreement or for an MMPDU shall be incremented every time transmission of a frame of length less than or equal to dot11RTSThreshold fails for that MSDU, A-MSDU, or MMPDU. When dot11RobustAVStreamingImplemented is true, the short drop-eligible retry count for an MSDU or A-MSDU that is not part of a Block Ack agreement or for an MMPDU shall be incremented every time the(#2283) transmission of a frame of length less than or equal to dot11RTSThreshold fails for that MSDU, A-MSDU, or MMPDU in which(#2283) the HT Control field is present and the DEI field is set. The unsolicited retry counter shall be incremented after the transmission of every A-MSDU that is transmitted using the GCR unsolicited retransmission policy. (#2335)

QSRC[AC] shall be incremented every time transmission of an A-MPDU or frame of length less than or equal to dot11RTSThreshold fails, regardless of the presence or value of the DEI field. When dot11RobustAVStreamingImplemented is true, QSDRC[AC] shall be incremented every time transmission of an A-MPDU or frame where the HT Control field is present, the DEI field is set to 1 and the length of the frame is less than or equal to dot11RTSThreshold fails. This short retry count and the QoS STA QSRC[AC] shall be reset when an A-MPDU or frame of length less than or equal to dot11RTSThreshold succeeds. When dot11RobustAVStreamingImplemented is true, the QoS STA QSDRC[AC] shall be reset when an A-MPDU or frame of length less than or equal to dot11RTSThreshold succeeds, regardless of the presence or value of the DEI field.

The long retry count for an MSDU or A-MSDU that is not part of a Block Ack agreement or for an MMPDU shall be incremented every time transmission of a MAC frame of length greater than dot11RTSThreshold fails for that MSDU, A-MSDU, or MMPDU. When dot11RobustAVStreamingImplemented is true, the long drop-eligible retry count for an MSDU or A-MSDU that is not part of a Block Ack agreement or for an MMPDU shall be incremented every time the(#2285) transmission of a frame of length greater than dot11RTSThreshold fails for that MSDU, A-MSDU, or MMPDU in which(#2285) the HT Control field is present and the DEI field is set to 1.

QLRC[AC] shall be incremented every time transmission of an A-MPDU or frame of length greater than or equal to dot11RTSThreshold fails, regardless of the presence or value of the DEI field. This long retry count and the QLRC[AC] shall be reset when an A-MPDU or frame of length greater than dot11RTSThreshold succeeds. When dot11RobustAVStreamingImplemented is true, QLDRC[AC] shall be incremented every time transmission of an A-MPDU or frame of length greater than or equal to dot11RTSThreshold fails where the HT Control field is present and the DEI field is set to 1. The QLDRC[AC] shall be reset when an A-MPDU or frame of length greater than dot11RTSThreshold succeeds, regardless of the presence or value of the DEI field.

All retransmission attempts for an MPDU that is not sent under a Block Ack agreement and that has failed the acknowledgment procedure one or more times shall be made with the Retry field set to 1 in the data or management frame.

Change the third paragraphs of 9.19.2.6 as follows:

**EDITORIAL NOTE: The change indicated below to the third paragraph also includes a change from a paragraph to a dashed list.**

Retries for failed transmission attempts shall continue until:(#2287)

* the short retry count for the MSDU, A-MSDU, or MMPDU is equal to dot11ShortRetryLimit, or
* ~~until~~ the long retry count for the MSDU, A-MSDU, or MMPDU is equal to dot11LongRetryLimit, or
* (#2039)the short drop-eligible retry count for the MSDU, A-MSDU, or MMPDU is equal to dot11ShortDEIRetryLimit, or
* the long drop-eligible retry count for the MSDU, A-MSDU, or MMPDU is equal to dot11LongDEIRetryLimit.
* the unsolicited retry count for the A-MSDU is equal to dot11UnsolicitedRetryLimit (#2335)

When ~~either~~ any of these limits are ~~is~~ reached, retry attempts shall cease, and the MSDU, A-MSDU, or MMPDU shall be discarded.

Change the fourth paragraphs of 9.19.2.6 as follows:

For internal collisions occurring with the EDCA access method, the appropriate retry counters (short retry counter for MSDU, A-MSDU, or MMPDU and QSRC[AC] or long retry counter for MSDU, AMSDU, or MMPDU and QLRC[AC]) are incremented. For internal collisions occurring with the EDCA access method where dot11RobustAVStreamingImplemented is true, the appropriate drop-eligible retry counters (short drop-eligible retry counter for an(#2288) MSDU, A-MSDU, or MMPDU and QSDRC[AC], or long drop-eligible retry counter for an(#2288) MSDU, AMSDU, or MMPDU and QLDRC[AC]) are incremented when the collision occurs for MSDU, A-MSDU or MMPDU that has drop eligibility set. For transmissions that use Block Ack, the rules in (Data and acknowledgment transfer using immediate Block Ack policy and delayed Block Ack policy) also apply. STAs shall retry failed transmissions until the transmission is successful or until the relevant retry limit is reached.

9.19.2.6.aa1 Unsolicited retry procedure

When using the GCR unsolicited retry(#2278) retransmission policy(#2113) for a group address, the AP or mesh STA may retransmit an MPDU to increase the probability of correct reception at the STAs that are listening to this group address (i.e., the group address is in their dot11GroupAddressTable). The set of MPDUs that may be retransmitted is dependent upon whether Block Ack agreements are active with the STAs that are listening to this group address, and is defined in 11.22.15.aa2.6.(#2116) How an AP or a mesh STA chooses which MPDUs to retransmit from this set is an implementation decision and beyond the scope of this standard. (#2109)(#2019)

A protective mechanism (such as a mechanism described in 9.22)(#2114) should be used to reduce the probability of other STAs transmitting during the GCR TXOP.

The TXOP initiation rules defined in 9.19.2.2 (EDCA TXOPs) and 9.19.3.3 (TXOP structure and timing) shall be used for initiating a GCR TXOP. The duration of a GCR TXOP shall be subject to the TXOP limits defined in 9.19.2.2(#2332).

When transmitting MPDUs using the GCR service with retransmission policy equal to GCR unsolicited retry(#2278):

* Following a MAC protection exchange that includes a response frame, in(#2291) all GCR unsolicited retry(#2278) retransmissions the STA shall either transmit the frames within a GCR TXOP separated by SIFS (#2331)or invoke its backoff procedure as defined in . The STA shall not transmit an MPDU and a retransmission of the same MPDU within the same GCR TXOP. The final frame transmitted within a GCR TXOP shall follow the backoff procedure defined in
* Without MAC protection or with MAC protection that lacks a response frame, in(#2293) all transmissions the STA shall invoke the backoff procedure defined in using a value of CWmin[AC] for CW,(#2294) at the PHY-TXEND.confirm that follows the transmission of each unsolicited retry GCR(#2333) MPDU.
* All retransmissions of an MPDU shall have the Retry field in their Frame Control fields(#2295) set to 1.
* During a GCR TXOP, frames may be transmitted within the GCR TXOP that do not use the GCR unsolicited retry(#2296) retransmission(#2113) policy.

9.20.3 Data and acknowledgment transfer using immediate Block Ack policy and delayed Block Ack policy

Change the first paragraph of 9.20.3 as follows:

After setting up either an immediate Block Ack agreement or a Delayed Block agreement following the procedure in 9.20.2 (Setup and modification of the Block Ack parameters), the originator may transmit a block of QoS data frames separated by SIFS period, with the total number of frames not exceeding the Buffer Size subfield value in the associated ADDBA Response frame. Each of the frames shall have the Ack Policy subfield in the QoS Control field set to Block Ack. The RA field of the frames that are not delivered using the GCR Block Ack(#2297) retransmission policy shall be the recipient’s unicast address. For GCR frames delivered using the GCR Block Ack(#2297) retransmission policy, the RA field of the frames shall be the GCR concealment (#2393)address. The originator requests acknowledgment of outstanding QoS data frames by sending a Basic Block-AckReq frame. The recipient shall maintain a Block Ack record for the block.

Change the fifth paragraph of as follows:

For frames that are not delivered using the GCR Block Ack(#2297) retransmission policy, the~~The~~ recipient shall maintain a Block Ack record consisting of originator address, TID, and a record of reordering buffer size indexed by the received MPDU sequence control value. This record holds the acknowledgment state of the data frames received from the originator. For frames that are delivered using the GCR Block Ack(#2297) retransmission policy, the recipient shall maintain a Block Ack record consisting of the DA address from the A-MSDU subframe header, TID, and a record of reordering buffer size indexed by the received MPDU sequence control value. This record holds the acknowledgment state of the group addressed data frames received from the originator.

9.20.aa10.3 GCR Block Ack BlockAckReq and BlockAck frame exchanges

A protective mechanism (such as transmitting an HCCA CAP, MCCA, RTS/CTS, setting the Duration field in the first frame and response frames to update the NAVs of STAs in the BSS and OBSS(s) or another mechanism described in 9.13 and 9.3.2.5) should be used to reduce the probability of other STAs transmitting during the GCR TXOP.

An originator may transmit no more than GCR Buffer Size A-MSDUs with RA set to the GCR concealment address and the DA field of the A-MSDU subframe set to the GCR group address when the retransmission policy for that group address is GCR Block Ack(#2297) before sending a BlockAckReq to one of the STAs that has a GCR Block Ack(#2297) agreement for this group address. The RA field of the BlockAckReq frame shall be set to the MAC address of the destination STA.(#2394) Upon reception of the BlockAck, an AP may send a BlockAckRequest to another STA that has a Block-Ack agreement for this group address, and this process may be repeated multiple times.

NOTE⎯If the originator sends a BlockAckReq to a STA with a MAC address that matches the SA in any of the A-MSDUs transmitted during the GCR TXOP, the Block Ack Bitmap will not acknowledge the MSDUs sourced from this STA. This is because the STA will have discarded all group addressed MPDUs transmitted by the AP that have the source address equal to their MAC address (see ). (#2117)

When a recipient receives a BlockAckReq with the GCR Group Address subfield equal to a GCR group address, the recipient shall transmit a BlockAck frame at a delay of SIFS after the BlockAckReq. The BlockAck acknowledges the STA’s reception status of the block of group addressed frames requested by the BlockAckReq frame.



Figure 9-aa1: Example of a frame exchange with GCR Block Ack(#2297) retransmission policy

Figure 9-aa1 shows an example of a frame exchange when the GCR Block-Ack retransmission policy is used. The AP sends several A-MSDUs using the GCR Block Ack(#2297) retransmission policy. The AP then sends a BlockAckRequest frame to group member 1 of the GCR group, waits for the BlockAck frame and then sends a BlockAckRequest to group member 2. After receiving the BlockAck frame from GCR group member 2, the AP determines if any A-MSDUs need to be retransmitted and sends additional(#2301) A-MSDUs (some of which might be retransmissions of previous A-MSDUs) using the GCR Block Ack(#2297) retransmission policy .

BlockAckReq and BlockAck frames might be lost or incorrectly received by the intended recipients. If the A-MSDUs requested for acknowledgement in the BlockAckReq have reached their lifetime limit, the process may be restarted by the originator transmitting an updated BlockAckReq with a new Block Ack Starting Sequence Control field. (#2118)

After completing the BlockAckReq and BlockAck frame exchanges, the originator determines from the information provided in the BlockAck bitmap and from the missing BlockAcks which, if any, (#2119)A-MSDUs (#2302)need to be retransmitted.

An originator adopting the GCR Block Ack(#2297) retransmission policy for a GCR group address chooses a lifetime limit for the group address. The originator may vary the lifetime limit for the group address at any time, and may use different lifetime limits for different GCR group addresses. The originator transmits and retries each A-MSDU until the appropriate lifetime limit is reached, or until each one has been received by all group members to which a BlockAckReq has been sent, whichever occurs first.

For GCR streams with retransmission policy equal to GCR Block Ack(#2297), (#2303)an originator may regularly send a BlockAckReq with the GCR Group Address subfield in the BAR Information field set to the GCR group address and the Block Ack Starting Sequence Control set to the Sequence Number field of the earliest A-MSDU of the GCR stream that has not been acknowledged by all group members and has not expired due to lifetime limits, in order to minimize buffering latency at receivers in the GCR group.

NOTE⎯This is because an originator might transmit management frames, QoS data frames with a group address in the Address 1 field (including different GCR streams), and non-QoS data frames intermingled. Since these are transmitted using a single sequence counter, missing frames or frames sent to group addresses absent from a receiving STA’s dot11GroupAddresses table complicates receiver processing for GCR streams with a GCR Block Ack(#2297) retransmission policy since the cause of a hole in a receiver’s Block Ack bitmap is ambiguous: it is due either to an MPDU being lost from the GCR stream or to transmissions of MPDUs not related to the GCR service using the same sequence number counter.

The beginning of reception of an expected response to a BlockAckRequest is detected by the occurrence of PHY-CCA. indication(BUSY,channel-list) primitive at the STA that is expecting the response where:

* The channel-list parameter is absent, or
* The channel-list is equal to {primary} and the HT STA expected to transmit the expected response supports 20 MHz operation only, or
* The channel-list is equal to either {primary} or {primary, secondary} and the HT STA expected to transmit the expected response supports both 20 MHz and 40 MHz operation (see 10.15.2 (Basic 20/40 MHz BSS functionality)).

If the beginning of such reception does not occur during the first slot time following a SIFS, then the originator may perform error recovery by retransmitting a BlockAckReq frame PIFS after the previous BlockAckReq frame when both of the following conditions are met:

* The carrier sense mechanism (see 9.3.2.2) indicates that the medium is idle at the TxPIFS slot boundary (defined in 9.3.7) after the expected start of a BlockAck, and
* The remaining duration of the GCR TXOP is longer than the total time required to retransmit(#2304) the GCR BlockAckReq plus one slot time.

NOTE⎯If an originator fails to receive a BlockAck frame in response to a BlockAckReq frame and there is insufficient time to transmit a recovery frame, the AP retransmits the BlockAckReq frame in a new TXOP.

10.5 Block Ack operation

10.5.2 Setup and modification of the Block Ack parameters

10.5.2.2 Procedure at the originator (#2387)

Change items b) to d) in the first paragraph of 10.5.2.2 as indicated:

1. Check whether the intended peer STA is capable of participating in the Block Ack mechanism by discovering and examining its “Delayed Block Ack” and “Immediate Block Ack” capability bits. If the recipient is capable of participating and the Extended parameter MLME-ADDBA.request primitive is set to false, the originator sends an ADDBA frame indicating the TID and the buffer size. If the recipient is capable of participating and the Extended parameter MLME-ADDBA.request primitive is set to true, the originator sends an Extended ADDBA frame indicating the TID and the buffer size.
2. If an ADDBA Response frame or Extended ADDBA Response frame is received with the matching dialog token and the TID and with a status code equal to 0, the STA has established a Block Ack mechanism with the recipient STA; and the MLME shall issue an MLME-ADDBA.confirm primitive indicating the successful completion of the Block Ack setup.
3. If an ADDBA Response frame or Extended ADDBA Response frame is received with the matching dialog token and the TID and with a status code not equal to 0, the STA has not established a Block Ack mechanism with the recipient STA; and the MLME shall issue an MLME-ADDBA.confirm primitive indicating the failure of the Block Ack setup.

10.5.2.3 Procedure at the recipient (#2387)

Change the first paragraph of 10.5.2.3 as indicated:

A recipient shall operate as follows in order to support Block Ack initialization and modification:

1. When an ADDBA Request frame or Extended ADDBA Request frame is received from another STA, the MLME shall issue an MLME-ADDBA.indication primitive.
2. Upon receipt of the MLME-ADDBA.response primitive, the STA shall respond by an ADDBA Response frame with a result code as defined in 7.4.4.2.
	1. If the result code is SUCCESS, the Block Ack is considered to be established with the originator. Contained in the frame are the type of Block Ack and the number of buffers that have been allocated for the support of this block.
	2. If the result code is REFUSED, the Block Ack is not considered to have been established.

10.5.2.4 Procedure common to both originator and recipient (#2387)

Change the first paragraph of 10.5.2.4 as indicated:

Once a Block Ack agreement has been successfully established between two STAs, the type of agreement thus established is dependent on the capabilities of the STAs and the contents of the ADDBA frames and Extended ADDBA frames used to establish this agreement as defined in Table 10-5 (Types of Block Ack agreement based on capabilities and ADDBA conditions).

Insert a new row in to Table 10-5 as indicated:

Table 10-5—Types of Block Ack agreement based on capabilities and ADDBA conditions

|  |  |  |
| --- | --- | --- |
| Capabilities condition | ADDBA condition | Type of Block Ack agreement |
| One or both of the STA are non-HT. | Block Ack Policy subfield equal to 1 | Immediate |
|  | Block Ack Policy subfield equal to 0 | Delayed |
| Both STAs are HT STAs. | Block Ack Policy subfield equal to 1 | HT-Immediate |
| Both STAs are HT STAs, and both of the STAs set the HT-Delayed Block Ack subfield of the HT Capabilities element to 1. | Block Ack Policy subfield equal to 0 | HT-Delayed |
| Both STAs are HT STAs, and at least one of the STAs sets the HT-Delayed Block Ack subfield of the HT Capabilities element to 0. | Block Ack Policy subfield equal to 0 | Delayed |
| Both STAs are robust AV STAs and the agreement was established using Extended ADDBA Request/Response frames. | Block Ack Policy subfield equal to 1, ADDBA GCR Group Address Present subfield equal to 1 | GCR-Immediate |

10.5.4 Error recovery upon a peer failure (#2339)(#2132)

Change the first paragraph of 10.5.4 as indicated:

Every STA shall maintain an inactivity timer for every negotiated Block Ack setup, unless the Block Ack is setup for a GCR group address.(#2339) The inactivity timer at a recipient is reset when MPDUs corresponding to the TID for which the Block Ack policy is set are received and the Ack Policy subfield in the QoS Control field of that MPDU header is Block Ack or Implicit Block Ack Request. The inactivity timer is not reset when MPDUs corresponding to other TIDs are received. The inactivity timer at the recipient is also reset when a BlockAckReq frame corresponding to the TID for which the Block Ack policy is set is received. The inactivity timer at the originator is reset when a BlockAck frame corresponding to the TID for which the Block Ack policy is set is received. When a timeout of BlockAckTimeout is detected, the STA shall send a DELBA frame to the peer STA with the Reason Code field set to TIMEOUT and shall issue a MLME-DELBA.indication primitive with the ReasonCode parameter having a value of TIMEOUT. The procedure is illustrated in Figure 10-14 (Error recovery by the receiver upon a peer failure).

Insert the following NOTE at the end of 10.5.4 (#2339)

NOTE⎯A Block Ack associated with a GCR group address does not use an inactivity timer because the GCR originator might switch between the DMS delivery method, the GCR unsolicited retry retransmission policy and the GCR Block Ack retransmission policy during the lifetime of a GCR agreement.

10.18 RSNA A-MSDU procedures (#2327)

Delete the NOTE at the end of 10.18

Add the following paragraph to the end of 10.18

An AP may transmit SPP A-MSDU for a GCR group address if it has successfully negotiated RSNA (re)associations with all associated STAs that have an active GCR agreement for this group address.

A mesh-STA providing GCR service may transmit SPP A-MSDU for a GCR group if it has successfully negotiated an RSNA (re)association with the peer mesh STA that requested GCR service.

11.22.15.aa2 GCR Procedures

11.22.15.aa2.1 Overview

A STA that implements the procedures defined in , , , and has the MIB attribute dot11GCRImplemented set to true. When dot11GCRImplemented is true, dot11MgmtOptionDMSImplemented and dot11HighThroughputOptionImplemented shall be true. A STA that implements advanced GCR supports GCR Block Ack(#2297) () and GCR-SP (), and has the MIB attribute dot11AdvancedGCRImplemented set to true. When dot11AdvancedGCRImplemented is true, dot11GCRImplemented shall be true. In a mesh BSS, a STA that implements (#2021) GCR has the MIB attribute dot11MeshGCRImplemented set to true. When dot11MeshGCRImplemented is true, dot11HighThroughputOptionImplemented shall be true.

Groupcast with Retries (GCR) is a flexible service to improve the delivery of group addressed frames while optimizing for a range of criteria. GCR service may be provided by the AP to associated STAs in an infrastructure BSS or by a mesh STA to its peer mesh STAs in a mesh BSS. GCR uses the setup, modification and termination procedures defined (DMS). The differences between GCR procedures and the DMS procedures are: (#2398)

1. A GCR agreement applies to a single group address whereas a DMS flow is not restricted to a single group address (TCLAS element(s) are not restricted to a single Ethernet classifier).(#2122)
2. DMS offers multicast-to-unicast conversion only,(#2163) whereas GCR includes several retransmission policies and delivery methods.

DMS allows the transmission of group addressed MSDUs as individually addressed A-MSDUs and is particularly suited to small(#2164) numbers of group members. It provides a high level of reliability but has low scalability as the efficiency decreases and delay increases proportionally to the number of group members.

GCR employs the DMS Request and DMS Response elements with the addition of GCR Request and Response subelements respectively for administering the announcement, set up, modification(#2123) and tear down of GCR services between an AP and non-AP STAs or between peer mesh STAs. The DMS procedures and state machine of shall apply to GCR with the extensions and constraints specific to GCR described below in to .

GCR defines two additional retransmission policies for group addressed frames, in addition to the mechanisms defined in (hereafter referred to as “No-Ack/No-Retry” or “non-GCR”), and (hereafter referred to as DMS):(#2165)

* GCR unsolicited retry(#2278)
* GCR Block Ack(#2297)

When using the GCR unsolicited retry(#2278) delivery method for a group address, the STA providing GCR service retransmits an MSDU one or more times (subject to applicable MSDU lifetime and retry(#2335) limits) to increase the probability of correct reception at STAs that are listening to this group address. The decision to retransmit these MSDUs is implementation dependant. GCR unsolicited retry(#2278) is particularly suited to use with large numbers of group members as it has moderate delay, efficiency and reliability, but high scalability.

The GCR Block Ack(#2297) delivery method extends the block acknowledgement mechanism to group addressed frames. The STA providing the(#2124) GCR service initiates block Ack agreements with each STA receiving GCR frames that supports GCR Block Ack(#2297) for a particular group address. Once this block Ack agreement is in place, the STA providing GCR service regularly sends Block Ack Request frames to the STAs receiving the frames to ascertain the reception status of MSDUs related to this group address, as described in . This allows the STA providing GCR service to discover MSDUs that have not been(#2166) received and to schedule their retransmission. GCR Block Ack(#2297) is particularly suited to use with moderate numbers of group members as it has moderate delay, high efficiency, moderate scalability and reliability.

The GCR service has two delivery methods for group addressed frames:

* As per (labeled “Active-PS”) or FMS (see 11.2.1.4a) in an infrastructure BSS, or as per 11C.13 in a mesh BSS (collectively labeled “non-GCR-SP”)
* GCR-SP (see )

EDITORIAL NOTE—Clause 11.2.1.4a is defined in and will be renumbered when incorporated into P802.11REVmb

EDITORIAL NOTE—Clause 11C.13 is defined in and will be renumbered when incorporated into P802.11REVmb

GCR-SP transmits GCR group addressed frames at intervals that might be less than the Beacon interval(#2044). Compared to non-GCR-SP, GCR-SP can provide(#2045) lower delay and jitter and moderate power savings.

11.22.15.aa2.2 GCR group membership procedures

The procedures described in clauses to depend upon the AP or mesh STA knowing the membership of the multicast groups of STAs that support GCR.

One method for an AP to discover the multicast groups that its associated STAs are receiving or for a mesh STA to discover the multicast groups to that peer mesh STAs are receiving is to use the Group Membership Request frame (as defined in ) to request the contents of the dot11GroupAddressesTable of its associated STAs or peer mesh STAs.

Other methods of group membership detection are also possible, using information that is outside the scope of this standard. For example group membership detection could be achieved via RFC 3376 (Internet Group Management Protocol (IGMP)) snooping.

An AP may transmit a Group Membership Request frame as an individually addressed frame to an associated STA that has indicated that it supports robust AV streaming (as indicated by the Robust AV Streaming bit set to one in the Extended Capabilities element) to request the associated STA’s dot11GroupAddressesTable. An AP shall not send a Group Membership Request frame to an associated STA that has the Robust AV Streaming bit set to zero in their Extended Capabilities element. (#2389)

A STA for which dot11GCRActivated or dot11MeshGCRActivated is true shall reply to a Group Membership Request frame by sending a Group Membership Response frame with the dialog token field set to the value from the Group Membership Request frame, the Address Count field set to the number of entries in dot11GroupAddressesTable and the Group Address List field set to the group MAC addresses in the dot11GroupAddressesTable. A STA for which dot11GCRActivated or dot11MeshGCRActivated is true shall set dot11GCRGroupMembershipAnnouncementActivated to true upon reception of a Group Membership Request frame.

A STA for which dot11GCRGroupMembershipAnnouncementActivated and at least one of dot11MeshGCRActivated or dot11GCActivated are true shall send an unsolicited Group Membership Response frame with the dialog token field set to 0, the Address Count field set to the number of entries in dot11GroupAddressesTable and the Group Address List field set to the group MAC addresses in the dot11GroupAddressesTable, every time the contents of the dot11GroupAddressesTable is modified.

If an unsolicited Group Membership Response frame is sent by an associated STA, the frame shall be a transmitted as a directed frame to the AP with which it is associated.(#2023) If an unsolicited Group Membership Response frame is sent by a mesh station in a mesh BSS, the frame shall be transmitted as a broadcast frame.

11.22.15.aa2.3 GCR setup procedures(#2171)

A GCR eligible STA is one that is either an associated STA with Robust AV Streaming set to 1 in the Extended Capabilities element in the STA's most recent (Re)Association Request or a peer mesh STA with Mesh Robust AV Streaming set to 1 in the Extended Capabilities element in the most recent mesh Beacon. If an AP for which dot11GCRActivated is true or a mesh STA for which dot11MeshGCRActivated is true detects(#2024) that a GCR eligible STA(#2172) is receiving one or more group addresses for which there is an active GCR service and it does not have a GCR agreement for the group(s), then the AP or mesh STA may alert the associated STA or peer mesh STA by sending an unsolicited individually addressed DMS Response frame that contains one DMS Status field with a GCR Response subelement per group address. Each DMS Status field includes a TCLAS element to identify the GCR group address, the DMSID corresponding to this GCR traffic flow, and other associated parameters. The Status field of this DMS Status field shall be set to “GCR Advertise”. The associated STA may ignore the DMS Response frame, or initiate a GCR agreement for one or more of the group addresses.

A STA may request use of the GCR service for a group address by sending a DMS Descriptor (as described in )(#2174) with the following modifications:

* The DMS Descriptor shall contain one TCLAS element with Frame classifier type equal to 0 (Ethernet parameters), one TSPEC element and one GCR Request subelement.
* The DMS Descriptor may contain other TCLAS elements in addition to the mandatory TCLAS element (that has a Frame classifier type equal to 0).
* When there are multiple TCLAS elements, a TCLAS processing element shall be present. Otherwise no TCLAS processing elements shall be present in the DMS Descriptor.
* The TSID subfield within the TS Info field of the TSPEC element shall be reserved. Since the AP might choose a delivery method of GCR-SP, the non-AP STA should set the Minimum Service Interval, Maximum Service Interval and Service Start Time fields in the TSPEC to indicate the STA’s preferred wake-up schedule. In a mesh BSS, the Delivery Method field shall not be set to "GCR-SP".
* The GCR Request subelement specifies the retransmission policy and delivery method requested by the non-AP STA for the group addressed stream.

A STA shall not request transmission of a group address via the GCR service while it has an active DMS service for this group address. A STA shall not request transmission of a group address via DMS while it has an active GCR service for this group address..

An AP or mesh STA accepts a GCR request by sending a DMS Status field with the Status field set to “Accept” (as described in )(#2175) with the following modifications:

* The DMS Status field shall include a GCR Response subelement indicating the retransmission policy,(#2025) delivery method and GCR Concealment Address for the group addressed stream. The Retransmission Policy field shall not be set to “No Preference”. The Delivery Method field shall not be set to “No Preference”. The GCR Concealment Address field of the GCR Response subelement shall be set to dot11GCRConcealmentAddress. In a mesh BSS, the Delivery Method field shall not be set to "GCR-SP".
* If the GCR group address stream is subject to the GCR-SP delivery method, then the AP shall also include a Schedule element in the DMS Status field indicating the wake-up schedule for the group addressed(#2128) stream.

For each GCR Request subelement, the AP or mesh STA may:

* Adopt the requested retransmission policy and delivery method, or
* Maintain its existing retransmission policy and delivery method, or
* Select an alternate retransmission policy and delivery method. or
* Deny GCR service for the group addressed stream. (#2402)

In an infrastructure BSS, the retransmission policy shall not be GCR Block Ack(#2297) for a GCR group address while the AP has a GCR agreement for the group address with a non-AP STA that had the Advanced GCR field set to 0 in the Extended Capabilities element in the (Re)Association Request most recently received by the AP.

In a mesh BSS, the retransmission policy shall not be GCR Block Ack(#2297) for a GCR group address while the mesh STA has a GCR agreement for the group address with a peer mesh STA that had the Mesh Advanced GCR field set to 0 in the Extended Capabilities element.

An AP or mesh STA denies a GCR request by sending a DMS Status field with the Status field set to “Deny” (as described in )(#2177) with the following modification:

* The DMS Status field shall include an empty GCR Response subelement

(#2403)If a(#2129) STA requesting GCR service determines that one or more GCR Response subelements are unacceptable, then the STA shall discard any received ADDBA request frames for the unacceptable GCR streams and the STA shall send a new DMS Request frame containing a DMS Request element with one DMS Descriptor for each unacceptable GCR stream. The DMSID fields shall be set to the DMSIDs of the unacceptable streams and the Request Type field shall be set to “Remove”.

In an infrastructure BSS, if the non-AP STA accepts the GCR Response, the non-AP STA(#2130) shall set dot11GCRConcealmentAddress to the value contained in the GCR Concealment Address field of the GCR Response subelement.

In a mesh BSS, if a STA requesting GCR service accepts the GCR Response, it shall add to dot11GroupAddressesTable the value contained in the GCR Concealment Address field of the GCR Response subelement.

In a mesh BSS, a GCR agreement instance is identified by a GCR agreement instance identifier. The mesh GCR agreement instance consists of the DMSID, localMAC, peerMAC, and Concealment address.

For each group addressed stream requested by the non-AP STA and accepted by the AP(#2131), the AP shall immediately initiate a Block Ack negotiation if(#2206) the following conditions are true:

* The AP advertised an Advanced GCR field set to 1 in its Extended Capabilities element
* The non-AP STA advertised an Advanced GCR field set to 1 in the Extended Capabilities element in the (Re)Association Request most recently received by the AP.

For each group addressed stream requested by a mesh STA, the peer (#2207)mesh STA(#2026) shall immediately initiate a Block Ack negotiation if both the mesh STAs advertised a Mesh Advanced GCR field set to 1 in their Extended Capabilities element in their most recently received mesh Beacon.

If all the above conditions are true the AP or mesh STA shall immediately initiate a Block Ack negotiation by sending an ADDBA Request frame to the STA that originated the GCR request. The Block Ack Policy field in the Block Ack Parameter field within the ADDBA frames shall not be set to 0 (for delayed Block Ack). The A-MSDU Supported subfield within the ADDBA frames shall be set to 1 (A-MSDU permitted). The Starting Sequence Number field within the ADDBA Request frames shall be greater than (modulo 4096) the last sequence number of the last group address frame transmitted before the ADDBA Request.(#2046) STAs shall maintain this Block Agreement for the duration of their GCR agreement, irrespective of whether the GCR Block Ack(#2297) is the current retransmission policy or not. While the retransmission policy of the GCR group address stream is DMS, the STA receiving GCR frames shall suspend its Block Ack processing for the group addressed stream.

NOTE⎯Having a Block Ack agreement with all members of a GCR group address allows the AP or mesh STA to change the GCR retransmission policy dynamically.(#2404)

A GCR agreement between a non-AP STA and an AP or between peer mesh STAs shall begin when the STA providing GCR service successfully transmits an individually addressed DMS Response frame with a DMS Response element containing a DMS Status field that has the Status field set to “Accept” (as described in )(#2209) with the

DMS Status field including(#2405) a GCR Response subelement.(#2210)

11.22.15.aa2.4 GCR Frame Exchange Procedures

In an infrastructure BSS, a GCR Block Ack(#2297) agreement exists between a non-AP STA and an AP for a group addressed stream from when the non-AP STA successfully transmits an ADDBA Response frame until:

* The AP or non-AP STA successfully transmits a DELBA frame to the other party.
* (#2132)The GCR agreement no longer exists.(#2211)

In a mesh BSS, a GCR Block Ack(#2297) agreement exists between a mesh STA and its peer mesh STA for a group addressed stream from the time(#2212) when the mesh STA successfully transmits an ADDBA Response frame to the peer mesh STA until:(#2213)

* The mesh STA or the peer mesh STA successfully transmits a DELBA frame to the other party.
* This GCR Block Ack(#2297) agreement expires (see 9.10.5).
* The GCR agreement is terminated.

An AP or a mesh STA may transmit a group address stream via the No-Ack/No-Retry (non-GCR; see ) service and GCR service simultaneously. Each frame shall be transmitted via the No-Ack/No-Retry retransmission policy before it(#2214) is transmitted via the GCR service, except when using the GCR-SP delivery method. The AP may transmit each frame via the No-Ack/No-Retry retransmission policy before or after it transmits the frame via the GCR service when using the GCR-SP delivery method. A STA providing GCR service may switch (#2406)between the DMS, GCR Block Ack(#2297) or GCR unsolicited retry(#2278) delivery modes, but only one delivery mode may be active at any given time for each GCR group address.

An AP or mesh STA shall transmit a frame belonging to a group address via the GCR service if any associated STA or peer mesh STA has a GCR agreement for the group address, and otherwise does not transmit the frame via the GCR service.

In an infrastructure BSS, an AP shall transmit a frame belonging to a group address via the No-Ack/No-Retry service if:

* The group address is the broadcast address, or
* The group address is not the broadcast address and at least one associated STA has the Robust AV Streaming bit set to 0 in the Extended Capabilities element of the STA’s most recent (Re)Association Request and has been determined by the AP to be a member of the group address (how this determination is made is out of scope of this standard),(#2215) or
* The group address is not the broadcast address and at least one non-AP STA has a Block-Ack agreement for the group address and the frame precedes the start of the Block Ack agreement (the sequence number of the frame is less than the starting sequence number of the block Ack agreement, as described in ).

In a mesh BSS, a mesh STA providing GCR service shall transmit a frame belonging to a group address via the No-Ack/No-Retry service if:

* The group address is the broadcast address, or
* The group address is not the broadcast address and at least one peer mesh STA has the Mesh Robust AV Streaming bit set to 0 in the Extended Capabilities element of the STA’s most recent mesh Beacon and has been determined to be a member of the group address (how this determination is made is out of scope of this standard), or
* The group address is not the broadcast address and at least one peer mesh STA has a Block-Ack agreement for the group address and the frame precedes the start of the Block Ack agreement (the sequence number of the frame is less than the starting sequence number of the block Ack agreement, as described in 9.10.2).

When the AP updates the retransmission policy, the AP shall set the Last Sequence Control field in the GCR response frame to the sequence number of the MPDU corresponding to the GCR traffic flow that is being updated that was delivered prior to the change in retransmission policy. (#2343)

To avoid undetected retries being passed up at a receiver’s MAC\_SAP(#2230), duplicate detection and removal for group addressed frames is required in STAs with dot11RobustAVStreamingImplemented set to true or dot11MeshRobustAVStreaming set to true (see ). A STA that requested GCR service and(#2420) has an active GCR agreement shall discard all MPDUs(#2217) and A-MPDUs(#2217) that have the Address 1 field set to the group address of this GCR group.

NOTE⎯While a GCR agreement is active, the STA (#2218)receives MSDUs for this group either via the STA’s(#2218) unicast MAC address (DMS delivery method) or the GCR concealment address (GCR Block Ack(#2297) or GCR unsolicited retry(#2278) delivery method).(#2219)

GCR frames shall be QoS data frames (with QoS subfield of the Subtype field set to 1).

If the Block Ack agreement is successfully established for the group addressed stream and the delivery method for the group addressed stream is GCR-SP, then the non-AP STA ensures it is awake for subsequent SPs (see ).

A STA may request a change of GCR service for a group(#2345) addressed stream by sending a DMS Descriptor with the DMSID identifying the group address and the Request Type set to “Change” (as described in )(#2220) with the following modifications:

* The DMS Descriptor shall contain zero TCLAS elements, zero TCLAS Processing elements, one TSPEC element and one GCR Request subelement.
* The TSPEC element and GCR Request subelement of this DMS Descriptor shall together contain at least one field that is different from the original TSPEC element and GCR Request subelement identified by the DMSID.

The AP or mesh STA may update the retransmission policy, delivery method, and schedule as the size of the group changes, the capabilities of the members of the group change, GCR Request subelements for the group are received, multicast diagnostics(#2222) or for any other reason. The AP or mesh STA advertises the current settings upon a change and periodically by either:

* Transmitting an unsolicited DMS Response frame with the current settings addressed to the GCR concealment address. This DMS Response frame shall be scheduled for delivery at the appropriate DTIM interval or SP in which(#2223) all STAs within the group are awake to receive the frame. One TCLAS element, one TSPEC element and one GCR Subelement shall be included per DMS Descriptor in the DMS Response element of the DMS Response frame to identify each GCR stream. The DMSID that identifies the GCR stream shall be included in(#2224) the DMS Descriptor. Each Status field in the DMS Status fields included in the frame shall be set to GCR Advertise.
* Transmitting unsolicited DMS Response frames with the current settings individually addressed to each GCR group member. Each GCR stream is identified by the DMSID in a DMS Status field in the DMS Response element of the DMS Response frame.(#2225) These DMS Status fields shall not include a TCLAS element, TSPEC element or GCR subelement(#2226). Each Status field in the DMS Status fields included in the frame shall be set to GCR Advertise.

STAs receiving GCR frames shall recover from missing group addressed GCR Response frames that advertise a changed retransmission policy or delivery method according to Table 10-aa1 or Table 10-aa2, respectively.

|  |
| --- |
| Table 10-aa1: STA recovery procedures for a changed retransmission policy |
| Current retransmission policy state at STA receiving GCR frames | Actual retransmission policy being used by the AP or mesh STA providing GCR service | Recovery procedure |
| GCR unsolicited retry(#2278) or GCR Block Ack(#2297) | No-Ack/No-Retry | A STA receiving GCR frames shall cancel(#2134) the GCR service for the group address, by sending a DMS Response frame that contains a DMS Descriptor with the Request Type set to “Remove”, when no frames for the group address are received via the GCR service after a period of dot11GCRPolicyChangeTimeout  |
| DMS | GCR unsolicited retry(#2278) or GCR Block Ack(#2297) | A STA receiving GCR frames shall update its current retransmission policy of the GCR stream to GCR unsolicited retry upon receiving an A-MSDU for the DMS group address concealed via the GCR Concealment address.  |
| GCR unsolicited retry(#2278) or GCR Block Ack(#2297) | DMS | A STA receiving GCR frames shall update its current retransmission policy of the GCR stream to DMS upon receiving an A-MSDU with the RA field set to the non-AP STA’s individual address and the DA field of the A-MSDU subframe set to the GCR group address. |
| GCR unsolicited retry(#2278) | GCR Block Ack(#2297) | A STA receiving GCR frames shall update its current retransmission policy of the GCR stream to GCR Block Ack(#2297) upon receiving a BlockAckReq frame with a GCR Group Address subfield set to the GCR group address |
| GCR Block Ack(#2297) | GCR unsolicited retry(#2278) | A STA receiving GCR frames shall update its current retransmission policy of the GCR stream to GCR unsolicited retry if MSDUs for the GCR group address concealed via the GCR Concealment address are being received yet no BlockAckReq frames for the GCR group address are received when the block ack agreement timeout occurs. |

|  |
| --- |
| Table 10-aa2: Non-AP STA recovery procedures for a changed delivery method |
| Current delivery method state at non-AP STA | Actual delivery method being used by the AP | Recovery procedure |
| Non-GCR-SP | GCR-SP | A non-AP STA shall update the current delivery method state of the GCR stream to GCR-SP if1. no frames with the More Data field in the Frame Control field set to 1 for the GCR stream are received for a period of dot11GCRPolicyChangeTimeout, and

at least one frame for the GCR stream with the More Data field in the Frame Control field set to 0 is received.Note that upon detecting condition a), the STA should enter the Awake state in order to assist with detecting condition b). |
| GCR-SP | Non-GCR-SP | A non-AP STA shall update the current delivery method of the GCR stream to Non-GCR-SP if 1. no frames with the More Data field in the Frame Control field set to 0 for the GCR stream are received for a period of dot11GCRPolicyChangeTimeout, and

at least one frame for the GCR stream with the More Data field in the Frame Control field set to 1 is received. |

A GCR agreement between a non-AP STA and an AP or between peer mesh STAs shall end (as described in )(#2227) when:

* In an infrastructure BSS, the AP deauthenticates or disassociates the non-AP STA, or
* In a mesh BSS, the mesh STA providing GCR service tears down the peer link to the mesh STA receiving GCR frames, or
* The non-AP STA or mesh STA receiving GCR frames successfully transmits a DMS Request frame to the AP or mesh STA providing GCR service containing a DMS Request element that has a DMS Descriptor with the DMSID identifying the group addressed stream and the Request Type field set to “Remove”, or
* The AP or a mesh STA providing GCR service successfully transmits an individually addressed DMS Response frame with a DMS Response element containing a DMS Status field with the DMSID identifying the group addressed stream that has the Status field set to “Terminate”.

A GCR agreement between a non-AP STA and an AP or between peer mesh STAs shall end (as described in )(#2228) with the following modifications:

* The DMS Status field shall include a GCR Response subelement.

 The DMS response frame may be(#2229) transmitted by an AP to the GCR concealment address or as an individually addressed frames to each STA that has an active GCR agreement for this GCR group address. The DMS response frame shall be transmitted by a non-AP STA or mesh STA as an individually addressed frame to the STA that it has an active GCR agreement with for this GCR group address (#2346)

A cancellation of a GCR agreement shall also cause the Block Ack agreement to be cancelled for the GCR stream.

11.22.15.aa2.5 Concealment of GCR transmissions

Concealment prevents group addressed frames transmitted via the GCR unsolicited retry(#2278) or GCR Block Ack(#2297) retransmission policies from being passed up through(#2230) the MAC\_SAPs(#2230) of GCR-incapable STAs.

GCR group addressed MSDUs transmitted via the GCR unsolicited retry(#2278) or GCR Block Ack(#2297) retransmission policies shall be sent in an A-MSDU frame format with the address 1 field set to(#2231) dot11GCRConcealmentAddress. The DA field in the A-MSDU subframe shall contain the(#2232) GCR group address that is being concealed (i.e.,(#2233) the same value as the DA field for non-GCR group addressed delivery). Multiple A-MSDU subframes may be contained within one A-MSDU frame, subject to the A-MSDU and MPDU size limitations, as described in 8.3.2.2.

A STA with dot11RobustAVStreamingImplemented set to true or dot11MeshRobustAVStreaming set to true shall not use its GCR Concealment address for any purpose other than the transmission of GCR streams.

A STA with dot11RobustAVStreamingImplemented or dot11MeshRobustAVStreamingImplemented set to true and a GCR agreement shall add the GCR Concealment address from the GCR response subelement to the STA’s dot11GroupAddressesTable.

An AP with dot11RobustAVStreamingImplemented set to true shall not send an MSDU to the DS that has the DA field set to the GCR concealment address.(#2103)

The Individual/Group (I/G) address bit (LSB of octet 0) and of dot11GCRConcealmentAddress shall be set to 1(#2347).

If the Universally or Locally administered (U/L) bit (the bit of octet 0 adjacent to the I/G address bit.) is set to zero, the OUI field of shall not be set to 01:00:5e or 33:33:00. (#2102)

NOTE⎯The restriction on the OUI field when the U/L bit is zero, is to avoid the use of a concealment address that would be in conflict with the MAC address space used for IPv4 and IPv6 multicast packets.

11.22.15.aa2.6 GCR unsolicited retry(#2278)

A STA supports the GCR unsolicited retry(#2278) retransmission policy if dot11RobustAVStreamingImplemented or dot11MeshRobustAVStreaming is true; otherwise the STA does not support the GCR service with retransmission policy equal to GCR unsolicited retry.

An AP or a mesh STA adopting the GCR-Unsolicited Retry retransmission policy for a GCR group address chooses a lifetime limit for the group address. The AP or a mesh STA may vary the lifetime limit for the group address at any time, and may use different(#2135) lifetime limits for different GCR group addresses. An AP adopting the GCR unsolicited retry(#2278) retransmission policy for a GCR group address shall transmit each MSDU according to , subject to the lifetime and retry(#2335) limits. Transmission uses the backoff procedure described in .

If a Block Ack agreement has successfully been established for a group addressed stream that is delivered using the GCR unsolicited retry(#2278) retransmission policy, the STA shall follow the duplicate detection procedures defined in and 9.20.4.

If a Block Ack agreement has successfully been established for all STAs receiving a GCR group address(#2136), for a group delivered using the GCR unsolicited retry(#2278) retransmission policy, the AP may retransmit any of the last *m* A-MSDUs that have the DA field in the A-MSDU subfield set to the GCR group address(#2136), where *m* is GCR Buffer Size (as defined in ), subject to the lifetime limits.

If there is a STA with an active GCR agreement for a group address (#2136)that does not have an active Block Ack agreement, the AP shall not retransmit a preceding A-MSDU for that group address. A preceding A-MDSU is defined as an A-MSDU with a sequence number value that precedes the sequence number value of the last transmitted A-MSDU for the GCR group address(#2136).

11.22.15.aa2.7 GCR Block Ack(#2297)

A STA supports the GCR Block Ack(#2297) retransmission policy if both dot11AdvancedGCRImplemented is(#2029) true or dot11MeshGCRImplemented is true; otherwise the STA does not support the GCR service with retransmission policy equal to GCR Block Ack(#2297).

The(#2138) GCR Buffer Size for a group address is defined to equal to the minimum Buffer Size field in the Block Ack Parameter Set field in the last received ADDBA.response for that group address across members of the GCR group (see ).

11.22.15.aa2.8 GCR-SP

The GCR-SP delivery method transmits GCR group addressed frames at (#2044)intervals that might be less than the beacon interval.

A STA supports the GCR-SP delivery method if dot11AdvancedGCRImplemented is true; otherwise the STA does not support the GCR service with Delivery method equal to GCR-SP.

NOTE⎯Group addressed traffic transmitted at the end of a DTIM beacon can be an impediment to providing QoS for uplink transmissions and in overlapping BSSs. Therefore APs in an overlapped environment are advised to make use of GCR-SP for group address traffic that consumes appreciable medium time.

Group addressed MSDUs shall not be transmitted via the GCR-SP delivery method policy if either the Active-PS or FMS delivery methods are active for that group address.

An AP advertises that a group address stream is subject to GCR-SP within a GCR Response subelement. The subelement indicates the start of each Service Period. See . When the Service Interval field in the Schedule element of the DMS Response frame is greater than 0, at(#2044) every scheduled SP the AP schedules for transmission buffered GCR-SP group addressed frames assigned to that particular group address.

An AP shall only accept either a GCR-SP or an FMS agreement for a group address stream from a single non-AP STA.

An AP may use the GCR-SP delivery method for an accepted GCR service when all the non-AP STAs that requested the GCR service for this group address have(#2139) the Robust AV Streaming bit in the Extended Capabilities element set to 1 and the Advanced GCR bit in the Extended Capabilities element set to 1, otherwise the AP shall not use the GCR-SP delivery method for the accepted GCR service.

When the Service Interval field in the Schedule element of the DMS Response frame is 0, the AP may transmit group addressed frames that are subject to this GCR agreement at any time without regard to the power state of non-AP STAs in the group. This is called Active GCR-SP, where all members of the group need to stay in Active mode to receive these group addressed frames.

11. Security

11.7 Per-frame pseudo-code

11.7.2 RSNA frame pseudo-code

11.7.2.8 Per-MSDU/Per-A-MSDU Rx pseudo-code (#2327)

**if** *dot11RSNAActivated* = TRUE **then**

**if** the frame was not protected **then**

Receive the MSDU or A-MSDU unprotected

Make MSDU(s) available to higher layers

**else if** address1 has an individual RA **then //** Have a unicast protected MSDU or A-MSDU

**if** Pairwise key is an AES-CCM key **then**

Accept the MSDU or A-MSDU if its MPDUs had sequential PNs (or if it consists

of only one MPDU), otherwise discard the MSDU or A-MSDU as a

replay attack and increment dot11RSNAStatsCCMPReplays

Make MSDU(s) available to higher layers

**else if** Pairwise key is a TKIP key **then**

Compute the MIC using the Michael algorithm

Compare the received MIC against the computed MIC

discard the frame if the MIC fails increment dot11RSNAStatsTKIPLocalMICFailures

and invoke countermeasures if appropriate

compare TSC against replay counter, if replay check fails increment dot11RSNAStatsTKIPReplays

otherwise accept the MSDU

Make MSDU available to higher layers

**else if** dot11WEPKeyMappings has a WEP key **then**

Accept the MSDU since the decryption took place at the MPDU

Make MSDU available to higher layers

**endif**

**else** // Have a group addressed MSDU or A-MSDU

**if** GTK for the Key ID does not exist **then**

discard the frame body **and** increment dot11WEPUndecryptableCount

**else if** GTK for the Key ID is null **then**

discard the frame body **and** increment dot11WEPUndecryptableCount

**else if** the GTK for the Key ID is a CCM key **then**

Accept the MSDU or A-MSDU if its MPDUs had sequential PNs (or if it consists

of only one MPDU), otherwise discard the MSDU or A-MSDU as a

replay attack and increment dot11RSNAStatsCCMPReplays

Make MSDU(s) available to higher layers

**else if** the GTK for the Key ID is a TKIP key **then**

Compute the MIC using the Michael algorithm

Compare the received MIC against the computed MIC

discard the frame if the MIC fails increment dot11RSNAStatsTKIPLocalMICFailures

and invoke countermeasures if appropriate

compare TSC against replay counter, if replay check fails increment dot11RSNAStatsTKIPReplays

otherwise accept the MSDU

Make MSDU available to higher layers

**else if** the GTK for the Key ID is a WEP key **then**

Accept the MSDU since the decryption took place at the MPDU

Make MSDU available to higher layers

**endif**

**endif**

**endif**

Annex C

(normative)

ASN.1 encoding of the MAC and PHY MIB

dot11GCRConcealmentAddress OBJECT-TYPE

SYNTAX MacAddress

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by the MAC or external management entity.

In an AP or mesh STA providing GCR service,changes take effect for the next MLME-START.request primitive.

In a non-AP STA or mesh STA receiving GCR service, it is written by the MAC when it receives a DMS Response that contains DMS Status field with a GCR subelement and a Response Type subfield set to Accept. (#2140)

The purpose of dot11GCRConcealmentAddress is to define the locally administered group address that is used by the GCR procedures (as defined in ) to conceal group addressed frames from STAs that do not support GCR"

::= { dot11StationConfigEntry <ANA> (#2362)}

Insert the following two entries after the “dot11EDCAAveragingPeriod” entry:

dot11UnsolicitedRetryLimit OBJECT-TYPE (#2335)

SYNTAX INTEGER (1..255)

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation

This attribute indicates the maximum number of transmission attempts of a frame delivered using the GCR unsolicited retry retransmission policy."

 DEFVAL { 7 }

::= { dot11OperationEntry <ANA> (#2362)}

* ***Insert “dot11MACbase4” to the “Groups - units of conformance” section as shown:***

dot11MACbase4 OBJECT-GROUP

OBJECTS { dot11MACAddress, dot11Address,

dot11GroupAddressesStatus,

dot11RTSThreshold, dot11ShortRetryLimit,

dot11LongRetryLimit, dot11FragmentationThreshold,

dot11MaxTransmitMSDULifetime,

dot11MaxReceiveLifetime, dot11ManufacturerID,

dot11ProductID, dot11CAPLimit, dot11HCCWmin,

dot11HCCWmax, dot11HCCAIFSN,

dot11ADDBAResponseTimeout, dot11ADDTSResponseTimeout,

dot11ChannelUtilizationBeaconInterval, dot11ScheduleTimeout,

dot11DLSResponseTimeout, dot11QAPMissingAckRetryLimit,

dot11EDCAAveragingPeriod,

dot11HTProtection,

dot11RIFSMode,

dot11PSMPControlledAccess,

dot11ServiceIntervalGranularity,

dot11DualCTSProtection,

dot11LSIGTXOPFullProtectionActivated,

dot11NonGFEntitiesPresent, dot11PCOActivated,

dot11PCOFortyMaxDuration,

dot11PCOTwentyMaxDuration,

dot11PCOFortyMinDuration,

dot11PCOTwentyMinDuration

dot11ShortDEIRetryLimit, dot11LongDEIRetryLimit, dot11UnsolicitedRetryLimit (#2335)}

STATUS current

DESCRIPTION

"The MAC object class provides the necessary support for the

access control, generation, and verification of frame check

sequences (FCSs), and proper delivery of valid data to upper

layers."

 ::= { dot11Groups <ANA> (#2362)}

References: